Keck Institute for Space Studies

List of Study Programs

2024 Programs:

1. Sample return from all across the Solar System
2. Metasurface Optics for High-Contrast Imaging: Design, Fabrication, and Implementation
3. Forging Community Consensus for an Integrated GHG and Winds Mission
4. Digital Twins for Solar System Exploration: Enceladus
5. Astronomical Optical Interferometry from the Lunar Surface

2023 Programs:

1. Blazing Paths to Observing Stellar and Exoplanet Particle Environments
2. Determining the Interior Structure of Uranus: A Case Study for Leveraging Cross-Discipline Science to Answer Tough Questions
3. The Biology of Biosignature Detection

2022 Programs:

1. Exploring Exoplanets with Interferometry
2. Developing a Continuity Framework for Satellite Observations of Climate
3. Targeting Microhabitats for Life Detection
4. Enabling Fast Response Missions to NEOs, ISOs, and LPCs
5. Caltech Space Challenge 2022 (Student-Led Program, Co-Sponsored)
2020 - 2021 Programs:

1. [COVID-19: Identifying Unique Opportunities for Earth System Science](#)
2. [Next Generation Planetary Geodesy](#)
3. [The Next-Generation Ground-Based Planetary Radar](#)
4. [Venus In-Situ Sample Capture Mission](#)
5. [Revolutionizing Access to the Martian Surface](#)
6. [Non-Nuclear Exploration of the Solar System](#)
7. [Real Time Detection and Tracking of Fires that Matter](#)

2019 Programs:

1. [Beyond Interstellar: Extracting Science from Black Hole Images](#)
2. [Nebulae: Deep-Space Computing Clouds](#)
3. [Sensing Forest Water Dynamics from Space: Towards Predicting the Earth System Response to Droughts](#)
4. [Data-Driven Approaches to Searches for the Technosignatures of Advanced Civilizations](#)
5. [Caltech Space Challenge 2019 (Student-Led Program, Co-Sponsored)](#)

2018 Programs:

1. [MarsX: Mars Subsurface Exploration](#)
2. [Unlocking a New Era in Biodiversity Science: Linking Integrated Space Based and In-Situ Observations](#)
3. [Tidal Heating – Lessons from Io and the Jovian System](#)
4. [Large Constellations and Formations for Exploring Interstellar Objects and Long-Period Comets](#)
2017 Programs:

1. Accessing the Subsurface Oceans of Icy Worlds
2. Cryogenic Comet Sample Return – Compelling New Science vs. Technological Challenges
3. Designing Future CMB Experiments
4. Next-Generation Approach for Detecting Climate-Carbon Feedbacks: Space-Based Integration of Carbonyl Sulfide (OCS), CO2, and SIF
5. The Architecture of LISA Science Analysis: Imagining the Future
6. Unlocking the Climate Record Stored within Mars’ Polar Layered Deposits
7. Caltech Space Challenge 2017 (Student-Led Program)

2016 Programs:

1. Addressing the Mars ISRU Challenge: Production of Oxygen and Fuel from CO2 Using Sunlight
2. Exoplanet Imaging and Characterization: Coherent Differential Imaging and Signal Detection Statistics
3. Optical Communication on SmallSats – Enabling the Next-Era in Space Science

2015 Programs:

1. Don’t Follow (Just) the Water: Does Life Occur in Non-AqueousMedia?
2. Exploring New Multi-Instrument Approaches to Observing Terrestrial Ecosystems and the Carbon Cycle From Space
3. Methane on Mars
4. Optical Frequency Combs for Space Applications
5. Three Dimensional (3D) Additive Construction for Space using In-Situ Resources
6. Caltech Space Challenge 2015 (Student-Led Program)
2014 Programs:

1. Adaptive Multi-Functional Space Structures for Micro-Climate Control
2. Bridging the Gap: Observations and Theory of Star Formation Meet on Large and Small Scales
3. Gazing at the Solar System: Capturing the Evolution of Dunes, Faults, Volcanoes and Ice from Space
4. Mapping and Assaying the Near Earth Object Population Affordably on a Decadal Timescale
5. Science and Enabling Technologies to Explore the Interstellar Medium
6. Venus Seismology

2013 Programs:

1. Airships: A New Horizon for Science
2. Inferring Thermal and Mechanical Properties of Celestial Bodies Regolith Using (Simple) Low-T
3. New Approaches to Lunar Ice Detection and Mapping
4. Planetary Magnetic Fields: Planetary Interiors and Habitability
5. Satellites to the Seafloor: Autonomous Science to Forge a Breakthrough in Quantifying the Global Ocean Carbon Budget
6. The Sleeping Giant: Measuring Ocean Ice Interactions in Antarctica
7. Caltech Space Challenge 2013 (Student-Led Program)
2012 Programs:

1. [CMB Polarization Cosmology in the Coming Decade](#)
2. [Engineering Resilient Space Systems](#)
3. [In Situ Science and Instrumentation for Primitive Bodies](#)
4. [New Methods to Measure Photosynthesis from Space](#)
5. [Quantum Communication, Sensing and Measurement in Space](#)
6. [Small Satellites: A Revolution in Space Science](#)
7. [Tools and Algorithms for Sampling in Extreme Terrain (Student-Led Program)](#)

2011 Programs:

1. [Asteroid Return Mission Study](#)
2. [Digging Deeper: Algorithms for Computationally-Limited Searches in Astronomy](#)
3. [High Altitude Ballooning for Space and Atmospheric Observation (Student-Led Program)](#)
4. [Monitoring of Geoengineering Effects and their Natural and Anthropogenic Analogues](#)
5. [Next Generation UV Instrument Technologies Enabling Missions in Astrophysics, Cosmology and Planetary Sciences](#)
6. [xTerramechanics - Integrated Simulation of Planetary Surface Missions](#)
7. [Caltech Space Challenge 2011 (Student-Led Program)](#)

2010 Programs:

1. [Future Missions to Titan: Scientific and Engineering Challenges](#)
2. [Innovative Approaches to Planetary Seismology](#)
3. [Innovative Satellite Observations to Characterize the Cloudy Boundary Layer](#)
4. [Quantifying the Sources and Sinks of Atmospheric CO2](#)
5. [The First Billion Years](#)
2009 Programs:

1. Climate Feedbacks and Future Remote Sensing Observations
2. Innovative Approaches to Exoplanet Spectra
3. Innovative Concepts in IR/Submm Astronomy from Space
5. Monitoring Earth Surface Changes from Space
6. Shedding Light on the Nature of Dark Matter
7. Single Photon Counting Detectors

2008 Programs:

1. Coherent Arrays for Astronomy and Remote Sensing
2. Large Space Structures
3. New Directions in Robotic Exploration of Mars